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Introduction

This field manual is designed to provide Special Forces (SF) engineers and unconventional warfare (UCW) personnel with several expedient methods of remote control (RC) detonation of explosive devices in a tactical unconventional warfare environment. The use of radio transmitters and receivers in the application of demolitions is, by its very nature, an exacting and precise science. It is assumed that the reader has no background in electronics or communications. However, the techniques described in this manual should only be applied by a skilled demolitions or engineering specialist with knowledge of the safe handling and deployment of munitions in a tactical environment.

The basic premise of this field manual is to meet the needs of the UCW commander and his engineering personnel in the construction and deployment of short- and medium-range RC detonation equipment without the use of special tools or sophisticated electronics skills.

The devices described in this manual can be designed and constructed using typically available materials in the urban UCW theatre in a minimal amount of time. *Commanders are*

advised to use caution and discretion in making this manual and all related documents available to indigenous personnel.

Chapter 1

Concept and Tactical Application of RC Detonation

The use of radio equipment to detonate any type of explosive device is limited by several factors. The type of transmitter and receiver available, distance from the target where detonation will occur, actual weather conditions, and possibility of "jamming" (radio frequency interference from both friendly and enemy communications equipment in the area) are all critical aspects of successful detonation. Although it is important to be aware of these considerations, testing and careful modification of the devices explained in this manual will eliminate problems with most of the above factors if the procedures are followed correctly. To verify your work, a final "dry run" field-test of your equipment should be done prior to positioning and arming the device.

It should be noted at this point that a "hard wire" emplacement of demolitions is considered to be more reliable and less sensitive to unknown conditions than RC detonation and should be implemented whenever it is technically feasible.

The use of RC detonation techniques is limited to the imagination of the UCW commander and his engineering and demolitions personnel. The following techniques constitute only a small portion of those available to anyone who wants to

use creativity and improvisation to their tactical advantage. It is technically possible to detonate an explosive device from any location on the planet using radio communications equipment that is commercially available or easily built by a skilled, electronics-trained demolitions specialist.

DESCRIPTION OF A TYPICAL RC SYSTEM

There are several basic components to an RC system that are common to all such devices. Figure 1 illustrates each of these components. An RC device is composed of a *transmitter* and *receiver* that are tuned to the same radio frequency (RF). The radio transmitter sends a signal over the airwaves, which is detected by the receiver. The RF contains not just a signal but also an audio tone *or* a group of tones modulated by the transmitter and demodulated by the receiver. These tones are known as *electronic pulses* and the signal used by an RC device is known as *pulse-coded modulation* (PCM).

The receiver is always on, waiting for the signal to be sent from the transmitter. When the detonation switch is depressed by the transmitter operator, the receiver detects the transmission, demodulates the PCM from the RF signal, and switches the circuit, which sends current to the blasting cap and causes it to explode and detonate the munitions. This is a rather simplistic explanation of what actually occurs during RC detonation, but it is a suitable explanation that is easy to understand and apply.

The RC devices that can be constructed in the field will all use basic electronic components, which will then be modified by either the demolitions or communications team member for use

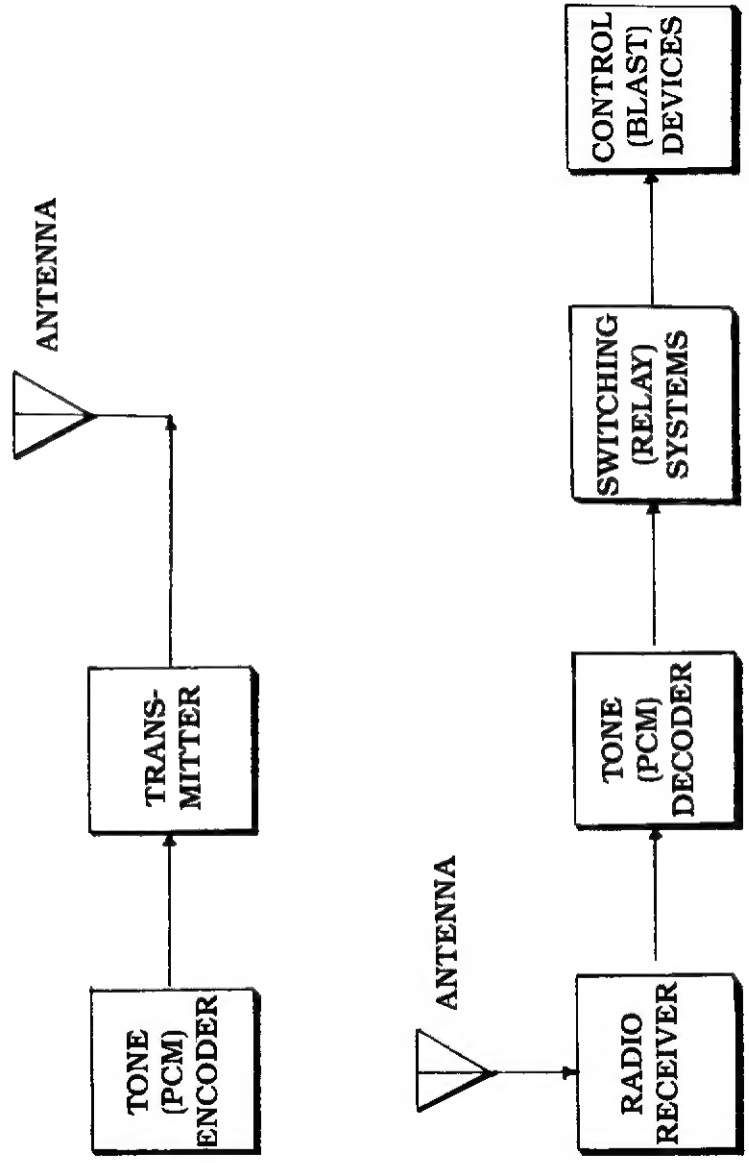

Figure 1

as a radio detonation device.

There are many common consumer electronics devices available throughout the world suitable for modification as RC devices. Although not specifically designed for the purpose of remote detonation of explosives, these items can be easily modified and used for this purpose, often with little or no change in the actual circuit involved.

The following consumer electronic devices are all capable of either short- or long-range RC detonation:

- Cordless electronic touch-tone phone
- Citizens band radio transceiver
- AM-FM portable "Walkman" type receiver
- FM wireless microphone
- Automobile "silent" paging alarm system
- Wireless intercom system
- Children's toy walkie-talkies
- Radio paging system
- Cellular mobile telephone
- VHF police scanner

Each of the above devices is either a radio receiver, transmitter, or both. The selection and modification of any particular device should be based on availability and specific application needs. Some of these devices are more limited in their range than others, and some are more sensitive to radio frequency interference (RFI). If it is possible to obtain any of these devices at random, then determine your specific needs and refer to Figure 2 for the most ideal device for your application.

Field personnel should not overlook their issued radio communications equipment for RC applications. Most portable radio transceivers

are very suitable for RC use. Obviously, a careful site survey and emplacement of team communications equipment well out of the blast zone should be implemented prior to detonation.

The following chapters will outline the expedient and reliable modification of each of the above consumer electronic items for use as an RC detonation device. For training purposes and universal availability of components, this manual will suggest using parts and tools available at any Radio Shack outlet in the United States.

Figure 2. Applications Table

DEVICE	RANGE	MOD-TIME	RELIABILITY
A	1 mile	2 hours	FAIR
B	5 miles	.5 hour	GOOD
C, D	1 mile	1 hour	FAIR
E	8 miles	1 hour	VERY GOOD
F	1/4 mile	1 hour	FAIR
G	1/4 mile	1 hour	FAIR
H	NA	10 minutes	EXCELLENT
I	35 miles	1 hour	EXCELLENT

DEVICE

A—cordless phone
B—CB radio
C—Walkman radio
D—wireless mike
E—auto page
F—wireless intercom
G—toy walkie-talkie
H—radio paging system
I—cellular mobile phone or VHF scanner

RANGE — Maximum range for PCM transmission

MOD-TIME — Time required to modify commercial unit

RELIABILITY — Comparing incidence of failure, interference, etc.

Chapter 2

Basic Electronics Theory and Equipment

In order to modify the devices described in this field manual, it is necessary to know how to use several electronic tools and pieces of equipment. This section is not meant as a replacement for more intensive electronics training but rather as a basic "primer" in elementary electronics. The following tools and test equipment will be needed to modify most of the devices outlined:

- Screwdriver (medium), flat tip
- Screwdriver (small), flat tip
- Screwdriver (medium), Phillips head
- Needle-nose pliers
- Wire cutters (small)
- Soldering iron (pencil type), 30 watt
- Volt-ohmmeter (VOM)
- Hook-up wire, solder, etc.

The Volt-ohmmeter required should be able to test AC voltage, DC voltage, resistance (ohms), and current (amps), as well as be battery-operated for field use. Radio Shack's model #22-212 pocket multitester is inexpensive and very suitable for this application.

The soldering iron should be of sufficient wattage to desolder heavy lug-type connections on

power supplies, as well as make strong connections to high-current electrical cables. Radio Shack model #64-2067 is recommended. If your intended area of operations does not have AC power capabilities, then it is recommended that you obtain a multipurpose, self-contained pocket gas torch for use as a field soldering iron, such as Radio Shack model #64-2164.

UNDERSTANDING BASIC ELECTRICITY

Electricity is measured in *volts*. Voltage is the value of electric current in relation to its intensity. The higher the voltage, the more force the electric current has. Electricity is also measured in *amps* (amperes). Amperage is the density or strength of the electric current.

If you compare a wire carrying electricity to a hose carrying water, the speed of the water (the water pressure) would be the voltage and the amount of water (or the water density) would be the amps.

Wattage is the voltage multiplied by the amperage of a device. For example, a light bulb that uses 100 volts and 1 amp of current is called a 100-watt bulb.

Resistance is the ability of an electrical conductor to allow current to pass through its mass. Resistance is measured in *ohms*.

Electrical energy is generally of two different types: *alternating current* (AC) or *direct current* (DC). Alternating current is voltage that changes or alternates in intensity. AC voltage is what comes out of the wall in your home, usually at a force around 110 volts. You can measure this voltage with your VOM by placing the setting on AC Volts and putting the probes directly into the wall socket.

Direct current is voltage that stays constant. All batteries are direct current. You can check your flashlight D cells with your VOM by setting the unit on DC Volts and placing the probes on each end of the battery. Note that if you connect them incorrectly, the meter needle slams to the left. This is because DC voltage has a positive and a negative side to it. Your flashlight battery should read 1½ volts. If it reads lower than 1 volt, then the battery is probably too weak to be used in your flashlight.

The VOM can also be used to test resistance. Set the VOM on Ohms and put the two probes together. The meter should read 0, because there is no resistance between the two probes. The VOM can therefore be used to check continuity; when running your detonation wire to a blasting cap, you can check the entire length for open or damaged wire by connecting the pair of wires together on one end and then checking the other end with your VOM. If it reads 0, then it is a good pair of wires. Use the VOM to test resistance in fuses and other electronic detonation components.

Caution: Do not attempt to check the resistance of a cap or any other type of electrical *ignition* device. The small amount of voltage that runs the ohmmeter section of your VOM will easily ignite the blasting cap.

MODIFICATION OF THE POWER SUPPLY

The main modification you will be performing on the devices described in this manual will be on the *power supply* section of the device. The power supply converts the AC wall voltage into DC for the circuitry inside the device, which needs a stable constant voltage.

The power supply is very easy to recognize in any electronic device. Always unplug the unit before working on it. Disconnect the power and then take the device out of its case by unscrewing the bottom set of screws. Follow the AC plug to the circuit board and it will lead to a large metal device called a *transformer*. The transformer is used to step down the AC from 110 volts to either 24, 12, 9, or 6 volts AC.

Plug the unit in again and use your VOM to see what the voltage is on the other end of the transformer. The transformer is usually the biggest component on the circuit board. Unplug the unit again and follow the circuit to the *diodes* or *bridge rectifier circuits* (see Figure 3). After the rectifier circuits, you will find a large- to medium-sized cylinder called an *electrolytic capacitor*. The capacitor takes the rectified AC and evens it out into a stable form of DC. This is where you want to set your VOM on DC Volts and measure the voltage coming out to find out how much DC the device you are modifying requires to run.

Plug the device back in and check the voltage at the two lugs underneath the capacitor. That voltage will usually be between 3 and 12 volts DC. This is where you are going to modify the unit to run on batteries. Unplug the device and plug in your soldering iron.

Soldering is very easy as long as you keep the iron clean and avoid using too much solder. As soon as the iron is hot (it takes about three to five minutes to heat up), you should "tin" the tip of your iron with some solder and then wipe the tip of the iron off with a damp cloth. Do this regularly to keep the iron clean and to avoid replacing the tip.

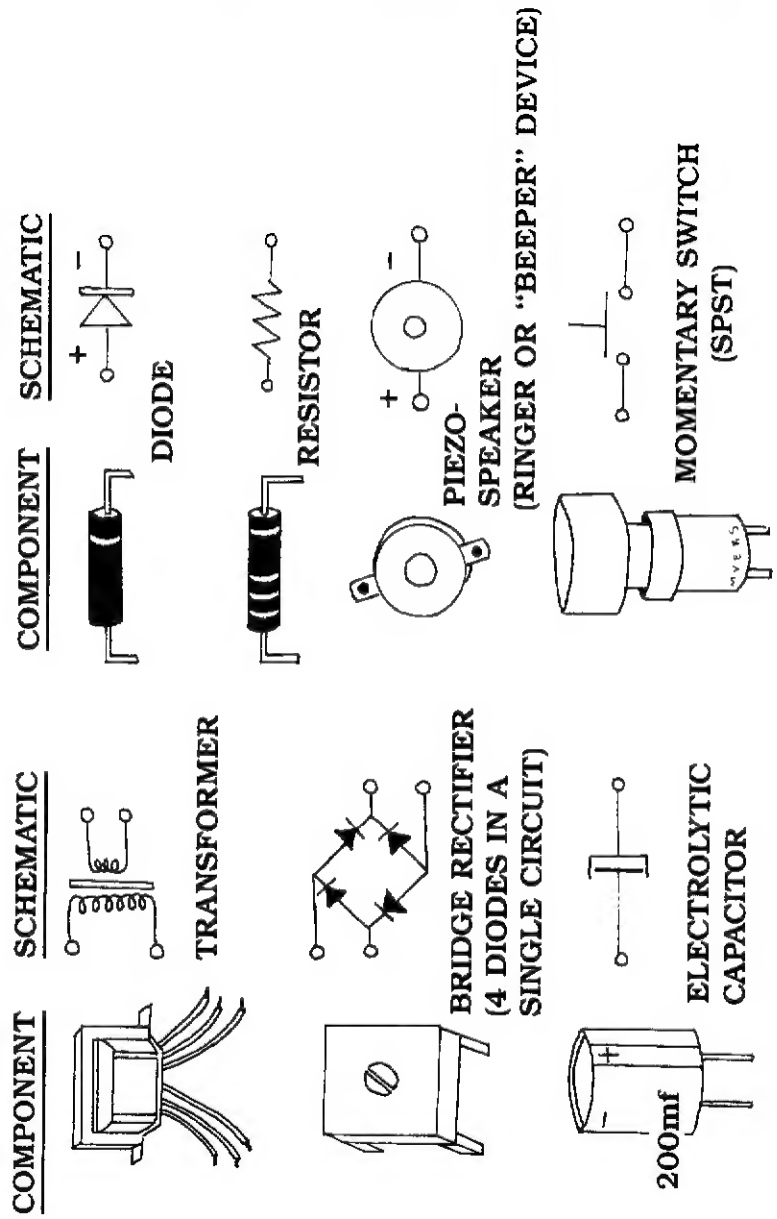

Figure 3

Use the iron to heat up the soldered terminals under the capacitor. When the solder melts, lift up each end of the capacitor and pull it carefully out of the socket on the circuit board.

Next take two long pieces of hook-up wire and strip the ends. It's best to use two different colors of wire, such as black and red. Place the red wire into the hole on the circuit board that was the positive (+) side of the capacitor (the capacitor is marked with a positive and negative side), then use your iron and a *small* amount of solder to set the wire in place. Connect the black wire to the negative (−) side of the capacitor socket.

You have just modified a device that plugs into the wall to run on batteries in the field. Whatever voltage you found at the capacitor terminals is the correct voltage at which to operate the device.

Chapter 3

Field-Expedient Audio Modulated Relay

There is an occasional need for a quick solution to a radio detonation problem. The UCW commander may need a field-expedient device for one-time use in an ambush or an assassination. The device must be completely destroyed in the blast and should therefore be as simple in design as possible. Once in the field, the availability of test equipment, tools, or components for an RC system may be very limited.

It is therefore useful to have the skill to create a *field-expedient audio relay* (FEAR) system from virtually any available materials. The FEAR unit is designed to operate off the audio signal from any available receiver and to detonate the munitions when an audio signal of sufficient duration is received from the transmission source. The FEAR unit does not require a separate power source to function because it utilizes the receiver's audio output to function, nor does it require semiconductors or electronic components. The design is flexible and materials are generally available in any UCW area of operations (AO).

The FEAR unit is composed of four basic components:

1. **Coil wire.** Any gauge insulated wire can be used, but the finer gauge wire available the better (i.e., bell wire, transformer wire, starter solenoid wire, speaker wire).

2. **Coil core.** Any thin piece of magnetic, iron, or steel base metal can be used (i.e., nail, screw, M16 firing pin, hairpin).

3. **Relay armature.** Any magnetic strip of thin metal (i.e., tin C-ration can, sheet metal).

4. **Relay base.** Any nonmetallic surface on which to mount the FEAR unit (i.e., wood, plastic, fiberglass).

Let's say, for instance, you have the following items at hand: bell wire, nails, large C-ration can, and a piece of wood. See Figure 4 and the following instructions:

1. Use your bayonet or the saw blade on your knife to cut the C-ration can into two strips 3 inches to 6 inches long and ½ inch to ¾ inch wide. Bend the strips so they are fairly straight.

2. Carefully and evenly wrap the bell wire around one of the nails at least one hundred times. Cut, and scrape the insulation off each end of the bell wire.

3. Mount the nail in the center of the piece of wood and pound it into the base securely.

4. Bend one of the metal strips into the shape of a Z. Then mount it over the top of the coil and secure the end to the base.

5. Bend the other strip into a Z shape. Then mount it on the wood base, facing the other strip over the coil.

You have constructed a simple electromagnetic relay. Put two more nails into the wooden base, and connect your coil wires to them. Connect a wire to the headphone or speaker connections on your receiver to the two terminals on the

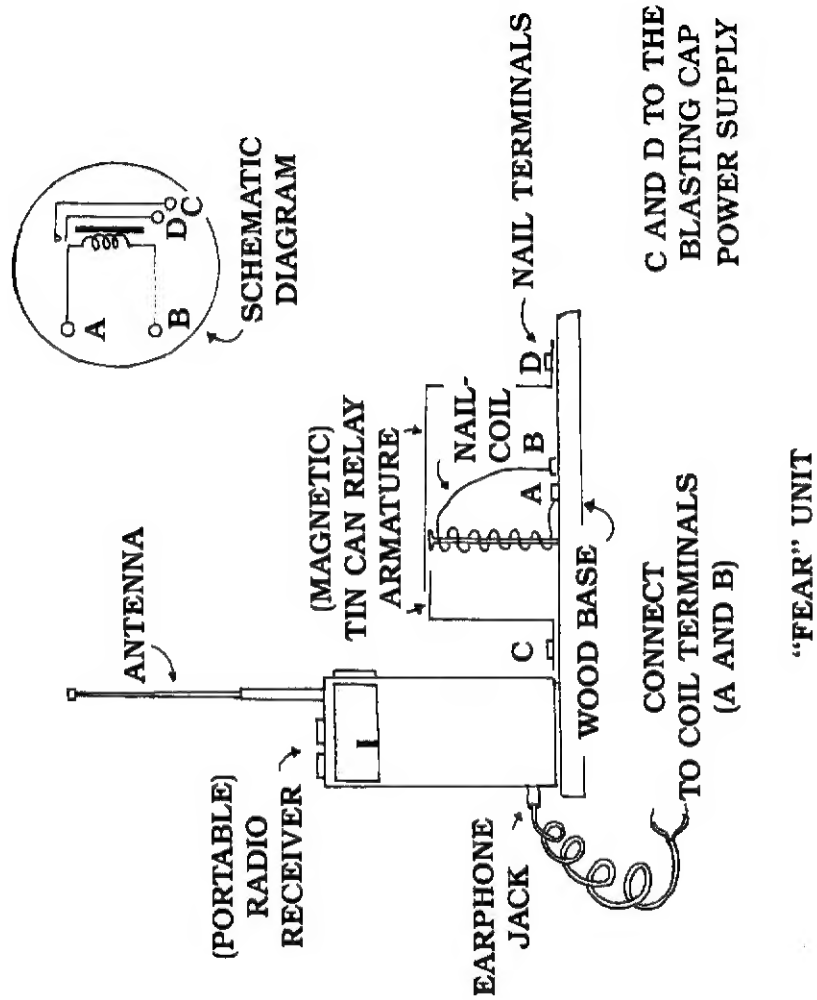

Figure 4

board. Tune the receiver to a station and turn the volume control up until the coil has enough current to pull the armature down to the head of the coil core nail. Adjust your two armatures on the board so that when one is pulled to the nail core it touches the other armature as well. Connect the battery for the demo charge to one terminal of the armature and connect the demo wire to the other terminal. When the audio signal from the receiver passes through the coil wires, it causes the armatures to connect and thereby close the electrical circuit to the explosives, detonating the charge.

Any available transmitter/receiver combination that is used for voice or tone communications can be used with the FEAR unit. Carefully adjust and test this unit prior to emplacement. If weather conditions are wet, place the FEAR unit and the receiver in a sheltered area, such as an ammo can or plastic-wrapped box. Keep in mind that if you put your receiver in a metal enclosure, you should place the antenna outside the enclosure so it will receive the transmission.

The FEAR unit has several disadvantages that must be very carefully considered before emplacement. Because the unit simply requires an audio signal to detonate, it is possible to have the unit unintentionally detonated before you wish, if a strong enough transmission occurs on the radio frequency to which the receiver is tuned. It is important to avoid any frequency that has even infrequent use for this reason. Keep your antenna wire short, and place the unit in the armed position as close to detonation time as possible.

A good fail-safe technique when using the

FEAR system is to design two relays connected to two receivers on separate frequencies. Relay 1 switches on the receiver to relay 2, which provides you with a safety margin in that one signal must be received to arm the unit and another to detonate the device.

You could just wire a timer into the system at any convenient point. This would at least allow for get-away time.

The FEAR system is a quick-fix solution to an RC problem that may occur when you are unprepared to provide Command with a safer, more advanced method of RC detonation. It should also be pointed out that the FEAR system is very easy to defeat should the target suspect that such a device is in place and be able to estimate its location.

This technique should also be kept unavailable to most indigenous forces due to its simple construction and design. These types of improvised skills have come back to haunt team members who have taught them to certain "friendly" operatives who then provided these techniques to hostile forces.

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Chapter 4

Touch-Tone Encoding and Decoding System

As you learned when you constructed the FEAR unit, a relay responds to an electrical signal from the audio output of a receiver, which switches on the electrical circuit that detonates the charge. The problem with the FEAR unit is that *any* signal on your receiver's frequency can cause the relay to switch on.

In order to make an RC system much more reliable, it is necessary to put a device between the receiver and the switching section that will wait for a specific signal on the receiver's frequency before switching the charge voltage to the blasting cap.

There are several methods available to accomplish this. For our purposes, we are going to construct a tone encoding and decoding system based on the touch-tone telephone system used in the United States.

DUAL TONE MULTI-FREQUENCY (DTMF) GENERATOR

The touch-tone signal coming from a telephone keypad is known as a *dual tone multi-frequency* (DTMF) signal. When you press one of the twelve

buttons on your phone, you send a specific tone down the phone line to the central office switching system.

An audio tone is actually an AC voltage. The pitch of the tone is known as the frequency of the AC signal. Audio tones are in the frequency of 20 to 20,000 hertz (Hz). The AC coming out of your wall socket has a frequency of 60 Hz. This low frequency can be heard by putting an AM radio close to a fluorescent light. This sound is known as *AC hum*.

The standard touch-tone phone generates two different frequencies each time one of the keys is pressed. These dual tones are the basis for our tone encoding and decoding system for a reliable DTMF RC system.

The frequencies of these dual tones on your telephone keypad are as follows:

Character	Frequency 1	Frequency 2
1	697 Hz	1209 Hz
2	697 Hz	1336 Hz
3	697 Hz	1477 Hz
4	770 Hz	1209 Hz
5	770 Hz	1336 Hz
6	770 Hz	1477 Hz
7	852 Hz	1209 Hz
8	852 Hz	1336 Hz
9	852 Hz	1477 Hz
0	941 Hz	1336 Hz
*	941 Hz	1209 Hz
#	941 Hz	1477 Hz

There are several methods of generating these tones in the field for use in an RC system. The easiest method is to purchase a touch-tone generator (Radio Shack model #43-139 is battery-operated and inexpensive). The team

communications NCO should have an audio-tone generator capable of producing any of these frequencies as well.

DUAL TONE MULTI-FREQUENCY (DTMF) DECODER

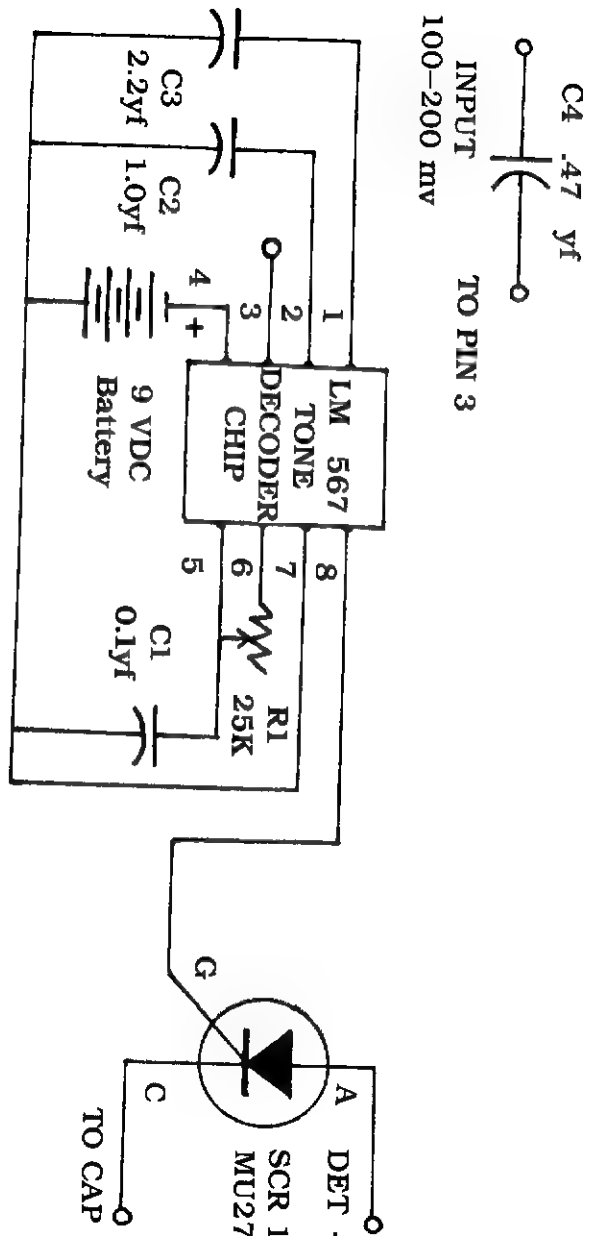
Use the DTMF generator on the transmit side of the RC system and a DTMF decoder on the receive side. Without going into a long technical description of how the DTMF decoder functions, suffice to say that this device is capable of recognizing specific tones and rejecting any other tones or signals.

The DTMF decoders discussed here also include an electronic switching system. Thus the need for a relay between the decoder and the detonation system is eliminated.

There are several DTMF decoders available. If you are going to use just one tone as your signal source, you can build a single-tone decoder quickly and inexpensively. Radio Shack has this circuit all on one tiny integrated circuit (IC) chip, called an LM567 (chip part #276-1721). It runs off a 9-volt battery for several weeks and retails for $1.99.

If you want to use several different tones for your blast detonation, which is advisable in a heavily congested urban area, then a complete DTMF receiver is recommended. Radio Shack has this circuit already on an IC chip as well, the SSI 202 (chip part #276-1303). It runs on 5 volts DC and retails for $12.95.

Both decoder packages include excellent documentation. Simply hook the audio output from your receiver to the input on the decoder. Adjust your volume control to low. Connect your charge



See also "Archer Semiconductor Reference Guide" for more useful circuits using this chip (i.e., DTMF Decoder, oscillator).

Parts List

C1	0.1yf	(RS 272–1069)
C2	0.1yf	(RS 272–1432)
C3	2.2yf	(RS 272–1435)
C4	.47yf	(RS 272–1433)
R1	25K	(RS 271–336)
LM567		(RS 276–1721)
SCR	1	(RS 276–1067)

Variable Frequency Tone Decoder

R1 × .1 = Input Frequency (Hz)
SCR Switching

Check R1 and set ohms out of the circuit with VOM.

Covers 500–2500 Hz @1–200mv RMS

Figure 5. Tone Decoder Circuit

detonation wire to the output switching terminals on the decoder and you are operational.

Figure 5 illustrates a simple-to-construct tone decoder that is capable of switching on with any frequency from 500 to 2,500 Hz.

The DTMF RC system is the most reliable means to safely and effectively detonate an explosive device. If Command requires detonation of several different explosive devices at specific times and/or locations, the DTMF RC system is extremely useful for this application. The single-tone receiver and a tone generator can easily be used to detonate twelve different explosions throughout your area of operations.

This is of particular use in base camp perimeter security applications as well as in convoy ambush missions.

The demo personnel on the team should have several DTMF units available to them for field use as part of their basic loads. These devices are lightweight and consume very little current.

Because the DTMF receiver is nonmechanical and small in size, it is both very reliable and difficult to detect. A well-installed and carefully emplaced DTMF system is also very difficult to defeat using standard electronic countermeasures (ECM). The tone transmission required to detonate a DTMF RC system need be only 100 milliseconds (1/10 of a second). Thus it is virtually impossible for your transmission to be located using radio direction finding (RDF) equipment.

The remainder of this field manual deals with specific types of consumer electronic devices available to you for modification. These devices are not limited to those described in this manual. Other devices that consist of a transmitter and receiver assembly can also be used to effect RC detonation. Experimentation and modification are all that are generally required for such devices as garage-door openers and model plane and car control systems.

Chapter 5

Modification of a Cordless Telephone

The U.S. market has been saturated with cordless telephone units over the past five years or so. These devices are available in any department store or consumer electronics store.

A cordless phone is actually a 2-channel (Duplex) transceiver. It generally operates on the frequency of 49 megahertz (MHz). These devices come from the manufacturer with a maximum range of approximately 1,000 feet under ideal conditions. This chapter will explain how you can effectively increase this range in excess of one mile, as well as how to modify the unit to function as an RC device in less than an hour.

A cordless phone system is composed of two components—the base unit and the hand-held portable unit. The base unit plugs into the phone line and a wall outlet. It transmits and receives the phone conversation from the portable unit over the phone lines. The base unit also has facilities to recharge the hand-held portable unit when it is not in use.

The hand-held portable unit uses rechargeable nickel-cadmium (ni-cad) batteries to operate. Most of the portable units are designed to run on 4.5 volts DC. Since the ni-cad batteries will

only function for about six to eight hours on a full charge, they are of little use for the application we have in mind.

Although any cordless phone can be modified using the techniques in this manual, it is best to obtain the type of unit that has the "paging" function. This allows you to eliminate several steps in the modification process.

The following modifications will be done on the cordless phone unit you have selected:

1. Modification of the power supply assembly on the base unit to function from batteries instead of AC.
2. Modification of the remote unit to operate on standard D-cell batteries for longer operation time.
3. Modification of the paging section on the remote unit to function as the detonation switching and blasting cap power source.
4. Modification of the base and remote unit's antenna to eliminate the whip antennas (which tend to break under normal field use) and greatly improve the range of the unit with an easy-to-conceal, thin-wire antenna assembly.
5. Installing both base and remote units into a shock-resistant, waterproof housing for extended field use.

Before attempting to perform these modifications, it is very important that you test the phone system out to ensure that you have a working unit. This is particularly important if you purchased the unit secondhand. The most common problem with these units seems to be weak or dead batteries in the remote unit. The second most common failure is that antenna connections on the remote are loose, or that the system

is simply out of range. Once you have ensured that you have an operational unit, then you are ready to begin.

MODIFICATION OF THE BASE-UNIT POWER SUPPLY

The procedure outlined in Chapter 2 of this manual is the best means to accomplish this modification. Since you will only be operating the base-unit assembly as a transmitter for very short durations, the power source can be of low current variety, such as AA cells hooked in series to the required voltage (1.5 VDC per battery cell). This also reduces weight. The batteries should be placed in a battery holder for reliability and ease of replacement. The following table suggests several different battery-box units for AA cells where different voltages may be required (available from Radio Shack):

Voltage Required	Cells	Part #
3.0 VDC	2	270–382
4.5 VDC	3	270–383*
6.0 VDC	4	270–383
9.0 VDC	6	270–387**
12.0 VDC	8	270–387

*This is actually a four-cell unit. Modify it for three cells by shorting out one of the cell locations by connecting the + side to the – side for that cell location with a wire.

**This is actually an eight-cell unit and you can modify it as stated above.

You can also reduce the weight of the base unit by removing the metal chassis on which the circuit board is mounted, as well as removing the power transformer, power cord, and recharger

terminals. This will reduce the weight of the base unit by more than 50 percent.

Mounted on top of the base unit case is a paging switch, which is used to notify the user of the remote unit that he is needed at the base location. This switch is called a *single-pole single-throw* (SPST) momentary switch. Clip the two wires from the terminals of this switch assembly, and replace the switch with a good, durable SPST momentary switch. Radio Shack has several available; model #275-609 is an excellent choice, though it requires a 1/2-inch hole to be drilled in the case of your unit. This switch is your detonation button, which will be mounted on the outside of your case assembly.

The last modification to your base unit power section is a power switch. This can be any SPST switch you have, but it should be durable and able to withstand exposure to the elements. It is recommended that you use a panel-mounted toggle switch for this reason. Radio Shack model #275-612 is good, and it requires a 1/4-inch hole to be drilled into the case of your unit. The power switch will function as your "arming" switch to the explosive device.

Test the completed unit assembly with the remote hand-held unit to ensure that it is operating correctly. Also, verify that the paging function works well; make sure it will set off the cap.

MODIFICATION OF THE REMOTE UNIT POWER SUPPLY

This is a relatively simple procedure. Open up the unit by removing the small screws on the bottom of the remote case. Locate the ni-cad batteries, which are generally located on the back

of the circuit board at the bottom of the chassis assembly. The batteries are almost always rectangular and about 1/2-inch thick. The operating voltage of the ni-cads is usually printed on the battery case. If not, check the voltage with the VOM. It is most often 4.5 to 6 VDC. The ni-cads in these units are usually replaceable, so simply slide them out of the terminal block. If the batteries are soldered into the unit, either clip or unsolder them.

Because the ni-cads are only designed to run a few hours, it is necessary to replace them with high-current D cells. The remote receivers tested with D cells have operated more than ten days in the stand-by receive mode. The D cells should be placed in battery holders. The following are the part numbers from Radio Shack for a variety of different voltages:

Voltage	Cells	Part #
1.5	1	270–403
3.0	2	270–386
4.5	3	270–389*
6.0	4	270–389

*This is actually a four-cell battery holder. You can modify it for three cells by shorting out one of the cells as described earlier.

You can reduce the weight and bulk of the remote unit by removing the circuit board from the chassis mount on the case, and then removing the touch-tone keypad, the earphone, and the microphone. The ringer device on the remote is a small, round electronic buzzer close to the microphone on the circuit board. If you are not sure where it is located, test the page function on the base and listen to the ringer beep. Discon-

nect the ringer from the circuit board and attach two pieces of hook-up wire to the terminals. This is going to be your detonation-wire hook-up point.

Connect the two ringer wires to an *enclosed* 1/8-inch jack (Radio Shack model #274-297, which requires a 3/16-inch hole). This will allow you to plug in your detonation wire directly from the chassis case.

The last modification needed on the power assembly off your remote unit is a power switch. Again, it is advised that you use a toggle-type SPST switch (Radio Shack model #275-612).

Test the completed modification by pressing the base unit paging switch and connecting your VOM to the two ringer terminals on the enclosed 1/8-inch jack. You should read anywhere from 1.5 to 3 volts when the page button is depressed.

You now have a cordless phone modified to operate on DC that will ignite a blasting cap when the detonation (paging) button is depressed. Now all that is left to do is increase the effective range of the unit, encase each unit in weatherproof housings, and then perform a final field-test before deployment.

MODIFICATION OF THE BASE AND REMOTE UNIT ANTENNAS

Warning: The procedures outlined in the following section will render the cordless phone to be in violation of FCC rules that govern such devices. Conviction of possession or operation of an unlawful transmission device can lead to fines and/or actual imprisonment in the United States.

The radio transmitter used in a cordless phone operates on a frequency of 49 MHz. The antenna

supplied with the typical unit has a length of 15 inches to 28 inches. The antennas are designed for use in close proximity to each other.

The proper way of determining the most effective length for a radio antenna is by taking the frequency wavelength in megahertz and dividing it into the number 936 to get the approximate length in feet for a full-wave vertical antenna. A half-wave antenna would require the frequency to be divided into 468, and a quarter-wave antenna would be divided into 234. Thus the 47 MHz frequency would be best served by the following lengths of vertical antennas.

- Full Wave (936/47 = 19.914893) or (approx.) 20 ft.
- Half Wave (468/47 = 9.9574468) or (approx.) 10 ft.
- Quarter Wave (234/47 = 4.9361702) or (approx.) 5 ft.

A 49 MHz unit would require the following lengths (cordless phones in the United States and overseas usually use one or the other):

- Full Wave (936/49 = 19.10204) or (approx.) 19 ft.
- Half Wave (468/49 = 9.551020) or (approx.) 9.5 ft.
- Quarter Wave (234/49 = 4.775510) or (approx.) 5 ft.

To get the maximum range from the cordless phone transmitter, it is necessary to replace the somewhat fragile whip antenna with a more durable and portable wire antenna. On each unit, you simply disconnect the wire leading to the antenna and connect it to another enclosed

1/8-inch jack (Radio Shack model #274-297). Short all three terminals on this jack and connect the antenna wire to it.

Since the ideal length for your 49 MHz transmission is a 20-foot antenna, you connect a 20-foot piece of wire to a 1/8-inch plug (Radio Shack model #274-286) and you are operational. Radio Shack makes a 1/8-inch plug already connected to 20 feet of thin black wire (model #42-2462), which is sold as a stereo headphone extension cord; this works very well.

If for tactical reasons the 20-foot length is not practical, use either a 10-foot or 5-foot antenna on either unit. Perhaps you will find it useful to use a 20-foot antenna on your receiver and a 5-foot antenna on your detonator base control unit. This works very well, and can produce detonation up to one mile away over flat terrain under good conditions.

Install the receiver antenna as straight in the air as possible. Place the wire over a tree or down the side of the target building. The advantage of a vertical antenna over a horizontal antenna is that the vertical antenna can receive equally well from any one direction, giving the detonation operator more freedom of movement. Consult with your communications specialist team member for other suggestions in antenna design and installation.

To test the system, short out the detonation switch with a piece of wire and walk as far away as you can with the receiver while still getting a reading at the ringer terminals.

INSTALLATION OF BASE AND REMOTE UNITS IN WEATHERPROOF HOUSING

The units should now be ready for placement

in a suitable enclosure. The conditions under which the equipment will most likely be used will determine how the system is enclosed. Let's assume that the units will be used in a wooded or jungle environment, exposed to extreme levels of heat and humidity, and subjected to typical abuse consistent with a standard tactical field operation.

The first concern is to protect the circuitry from shock or damage from weather elements. Under these conditions, a sturdy metal enclosure is ideal. An ammo box, weapons case, or any other sealed metal enclosure is suitable for this purpose. Radio Shack has several types of metal enclosures in its 270 stock number series that will also work well.

Select the unit based on the size of your complete system. After drilling holes in the enclosure for the jacks, switches, and cables, seal the inside of the installed switch or jack assembly with epoxy or caulking compound. This will keep the internal electronic circuitry dry if the unit becomes exposed to rain or immersed in water.

Before installing the circuit-board assembly into the weather-sealed enclosure, it is a good idea to place a paper towel in the enclosure, reseal it, and then submerse the device in water for at least 24 hours. If after this period the paper towel is still dry, *then* you have a weatherproof enclosure.

APPLICATION NOTES FOR CORDLESS PHONE MODIFICATION

System advantages:

1. Both receiver and transmitter are *crystal-controlled*. This allows for steady, consistent reception even under adverse field conditions

and battery degradation.

2. *Durability*. The remote unit circuitry is surprisingly well constructed and the device is designed for a bit of abuse by the consumer, both indoors and out.

3. *Tone-controlled*. In a field environment, the possibility of accidental detonation is unlikely.

System disadvantages:

1. *Frequency*. Many countries use the 49 MHz frequency for tactical field communications. Increased traffic on this frequency can make the unit susceptible to both electronic countermeasures (ECM) and radio frequency interference (RFI).

2. *Usage*. Because of the proliferation of these devices in the urban environment (as well as other tone-controlled devices also operating on this frequency), the unit is best suited for remote field applications to avoid accidental detonation.

3. *Single channel*. The unit can not be used for multiple field detonation and is best suited for short-range sabotage and assassination mission deployment.

Chapter 6

Modification of a Citizens Band Radio

The standard U.S.-manufactured citizens band radio is available virtually anywhere in the country. It is inexpensive and easy to operate. Although there are no licensing requirements to own or operate these devices, their use is still controlled and regulated by the FCC. Federal Regulation Code No. 47, subpart D, part 95 of the FCC rules governs the use of this equipment.

A standard 40-channel, 5-watt CB radio will broadcast voice transmissions several miles, depending on the weather conditions, antenna type and installation, and the type of unit you own. The maximum range at which you may operate a CB radio is 155 miles, which can be accomplished with a good antenna system. For practical purposes, the range for walkie-talkies or basic, inexpensive mobile units will be generally limited to 5 to 12 miles.

There are several manufacturing companies that offer long-range "linear" amplifiers for citizens band radios. Possession or use of these devices will result in prosecution by the FCC (it should be noted that the FCC has a very sophisticated and effective RDF capability). If you want your unit to have a range of several

hundred miles outside the U.S. border, several sources for linear amps are described at the end of this section.

The CB radio operates in the 27 MHz frequency range. The forty channels on the radio are each a specific frequency. These frequencies are listed below for use by the communications NCO, should the team's high frequency (HF) radio be used in conjunction with these units in the field.

CITIZENS BAND RADIO CHANNEL FREQUENCY CHART.

Channel	Frequency	Channel	Frequency
1	26.965 MHz	21	27.215 MHz
2	26.975 MHz	22	27.225 MHz
3	26.985 MHz	23	27.255 MHz
4	27.005 MHz	24	27.235 MHz
5	27.015 MHz	25	27.245 MHz
6	27.025 MHz	26	27.265 MHz
7	27.035 MHz	27	27.275 MHz
8	27.055 MHz	28	27.285 MHz
9*	27.065 MHz	29	27.295 MHz
10	27.075 MHz	30	27.305 MHz
11	27.085 MHz	31	27.315 MHz
12	27.105 MHz	32	27.325 MHz
13	27.115 MHz	33	27.335 MHz
14	27.125 MHz	34	27.345 MHz
15	27.135 MHz	35	27.355 MHz
16	27.155 MHz	36	27.365 MHz
17	27.165 MHz	37	27.375 MHz
18	27.175 MHz	38	27.385 MHz
19	27.185 MHz	39	27.395 MHz
20	27.205 MHz	40	27.405 MHz

*Channel 9 is designated "Emergency Use Only" by the FCC.

Modification of the citizens band radio is simple and straightforward. Using your tone-encoder module (such as Radio Shack model #43-139), place the speaker of the tone-encoder to the microphone of the radio. Test this procedure with another radio some distance from your unit to verify that the tone is transmitted clearly and at a sufficient volume. It should be noted that digital tone transmissions are illegal on the citizens band radio frequencies, so keep these transmissions short.

Key the mike of the radio and press one of the twelve tone buttons on the encoder to send the DTMF transmission to your receiver.

The receiver unit has a speaker or headphone jack on either the front panel or the back of the unit. This is usually a 1/8-inch plug. Connect your DTMF receiver or tone-controller module to the jack and you are operational. Since the CB radio equipment has other uses besides RC detonation, it is suggested that you place your receiver well out of the blast zone. Also, always keep your tone-encoder separate and unattached to the CB mike to avoid confiscation by the FCC for sending tone over the airwaves.

The following list of firms and organizations in the United States can provide you with kits, plans, and instructions for the construction of linear amplifier units that can (illegally) increase your effective range to several hundred miles:

CBCI
P.O. Box 31500
Phoenix, AZ 85046

CB Operators of America
11 Colin Avenue
Uniontown, PA 15401

Pan-Com
P.O. Box 130
Paradise, CA 95967

Huntley Radio
11721 Eureka Road
Edinboro, PA 16412

The following magazines also have advertisers for CB radio modifications and equipment:

Radio Electronics
P.O. Box 51866
Boulder, CO 80321-1866

Popular Communications
76 North Broadway
Hicksville, NY 11801

Chapter 7

Modification of an FM Wireless Microphone and Portable Receiver

The standard FM portable radio receiver, such as the "Walkman" type or AM-FM portable, is a lightweight, reliable battery-operated receiver generally capable of receiving FM transmissions in excess of thirty miles from the transmitter.

The FM wireless microphone is a small transistorized radio frequency (RF) transmitter which operates on the 88–108 MHz FM frequency band. This device is available from a variety of suppliers, including Radio Shack (a list of suppliers is provided at the end of this section). These units are usually priced under $50 and usually operate on a standard 9-volt battery. The effective range of these devices is usually from 300 feet to—with modified antennas, etc.—more than 3 miles. It is, however, against FCC regulations to operate these devices at ranges in excess of one mile (Federal Regulation Code 47, part 15 contains the regulations for these devices).

Using your DTMF encoder and decoder assembly with these devices is also in violation of FCC rules. However, the unit you can construct using these transmitter and receiver combinations can be as small as a cigarette lighter and is very suitable for both urban and tropical

UCW operations. Use of these devices in the United States is not recommended.

Of the units available for use in this application, the DECO Industries model WAT-50 miniature FM transmitter is the most efficient, and it is easy to build from kit form. This device is about the size of a quarter and will broadcast DTMF pulse well over a mile to a standard FM receiver. The WAT-50 also has another advantage over most of these devices in that it can transmit from 70 to 130 MHz, which allows the user to send his transmission out of the normal FM broadcast band frequencies. Using a portable aircraft receiver (Radio Shack model #12-601 is inexpensive and easy to modify), the user can avoid having his tone traffic picked up on the standard FM radios in the area.

To use the receiver-transmitter combination, simply send a tone over the transmitter with your encoder and plug your tone decoder directly into the earphone jack of your receiver.

The following is a partial list of the manufacturers of FM wireless microphone kits and units.

CAS Electronics
1559-J Amar Rd. #457
West Covina, CA 91782

DECO Industries
P.O. Box 607
Bedford Hills, NY 10507

Electronic Pursuits
1269 Broadway
El Cajon, CA 92021

Information Unlimited
P.O. Box 716
Amherst, NH 03031

Microtron
42 38th St.
Wheeling, WV 26003

RF Electronics
826 W. Valley Blvd. #135
Alhambra, CA 91803

Spy Shops International
P.O. Box 1738
Englewood Cliffs, NJ 07632

USI Corp.
P.O. Box 2052
Melbourne, FL 32902

Chapter 8

Modification of an Auto-Alarm Paging System

Auto-alarm paging systems provide the user with a "silent" alarm warning system for his car or truck. If someone attempts to hot-wire or gain entry to the vehicle the alarm sends a radio signal through the car's antenna to a beeper that the owner wears on his belt.

The devices available for modification are manufactured in the United States and Japan by several firms (Radio Shack sells two models). All these devices have similar technical characteristics and are suitable for modification.

The typical auto-alarm page transmitter operates from the car's 12 VDC battery. It has a range of two to eight miles, and is priced well under $100 retail. The units usually have one or two pagers with the system; extra pagers are priced around $30 each.

These devices are generally 4- to 5-watt, crystal-controlled, 8-bit digital transmitter and receiver assemblies. They are built to operate in the frequency of 27.145 MHz in the United States. According to FCC rules governing these devices, these units may not have an operating output power in excess of 5 watts. It should be noted that the frequency of 27.145 MHz is actu-

ally between CB channels 15 and 16. These devices can be illegally attached to any of the standard linear amplifiers for a range of several hundred miles.

The typical pager alarm unit can operate 3- to 9-volt batteries for several days. These units are durable and very easy to conceal.

All the units available on the U.S. market use a digital binary-coded signal to set off the specific receiver used with each individual alarm. Most of these units have a small switch assembly on both the transmitter and receiver. These switch assemblies are generally 8-pin dual in-line package (DIP)-type, two-position switches, which the operator sets with a pen or thin-tipped screwdriver. The standard 8-pin DIP switch assembly provides the user with 256 different combinations of binary signals to select from. When purchasing one of these units, it is best to determine how many different tone combinations are available. Radio Shack model #49-791 has 256 possible combinations and is ideally suited for this application due to the "Page" button already installed on the front panel.

Although this type of binary switching system is not a true DTMF-type device, it is nonetheless a digital transmission of PCM and is very reliable to use in both the field or an urban environment.

The typical receiver available with these devices will have a small rod or wire antenna built into the case of the pager. These antennas are generally between 2½ inches and 4 inches long. We will modify this antenna connection for both increased range and a higher degree of reliability in receiving the binary tone transmission from the transmitter. It is suggested that you purchase at least six extra receivers for your unit so that you can modify them all at once, as

well as have the capability of a multichannel RC detonation unit once you become operational with the system.

The standard auto-alarm page system uses the same basic technical basis for operation as the devices used by the U.S. Army Special Forces Radio Detonation Unit, issued to SF demo personnel for team level radio detonation in the UCW AO. These units are digital multichannel high-frequency transmitter and receiver assemblies enclosed in weatherproof housings. They are used to detonate several different explosive devices at different locations within the range of the unit transmitter.

The weatherproof 1.5-volt D-cell-operated receiver has three terminals on top of the case. The demo operator connects a small piece of wire to the antenna terminal and the demo charge wires are connected to the other two terminals.

The transmitter has a stainless steel whip antenna enclosed in the handle of the transmitter case. A bank of numbered rotary "thumbwheel" switches for selecting the specific receiver and a "detonation" transmission switch are mounted on the front panel of the transmitter unit. These units are crystal-controlled and can operate on a variety of frequencies (these various frequency allocations are, of course, classified). This unit has been in use for some time by SF team members throughout the world, and they have had excellent results with them in the field.

The device that we are going to construct will function in the same manner as these SF units. Of all the consumer electronic devices available to you for modification, the auto-alarm page system is by far the most reliable, and it is easy to modify and use for standard RC detonation

of multiple targets.

The following modifications will be performed on the auto-alarm paging system to make the device operational as an RC detonation unit:

1. Modification of the transmitter unit to operate on D or AA cells for tactical field use.
2. Modification of the receiver unit (pager) to operate on D cells for extended emplacement.
3. Modification of both transmitter and receiver assemblies antenna connections (with wire antennas) for extended range.
4. Installation of both units in weatherproof enclosures for tactical field use.

It should be stressed at this point that most of the devices used for auto-alarm paging systems are somewhat inexpensive. There is, however, a great number of possible differences between individual makes and models. The following criteria should be followed when selecting an alarm system for modification:

- Minimum range of transmission of two miles
- Large number of possible tone combinations
- "Page" button on front panel
- 12-volt negative ground
- Metal case for transmitter unit
- Minimum power output of 4 watts

MODIFICATION OF THE BASE UNIT POWER SUPPLY (TRANSMITTER)

The transmitter unit is generally designed to operate from a car battery, therefore operating on a 12 VDC power source. In order to use the transmitter base unit in the field, it is necessary to modify the connectors on the back of the unit

to allow the use of a 12-volt D-cell or AA-cell battery-box. Use Radio Shack model #270-387 for 12-volt AA cells and model #270-396 for 6-volt D cells, which means you need two for this unit.

Follow the installation instructions for placement in an automobile electric system and simply connect the two wires to your battery-box for field use. If you wish to install a power switch to the device, use a toggle switch between the positive battery lead and the battery-box. You can bypass the fuse that comes standard with these devices for field use as well.

MODIFICATION OF THE RECEIVER UNIT (PAGER) POWER SUPPLY

The receiver unit usually operates on a 9-volt battery. If you are going to be installing this unit and detonating the charge within 24 to 48 hours, this modification is not necessary. If you want this modification to operate for several weeks on the standby receive mode, use the D-cell chart in the cordless phone section.

MODIFICATION OF RECEIVER AND TRANSMITTER WITH WIRE ANTENNAS

The transmitter unit is designed to use the vehicle's radio antenna for transmitting the digital signal to the pager. The typical auto radio antenna is between 31 inches and 51 inches long and is designed for AM and FM broadcast signals. Using the formula described in the cordless phone section of this manual, the best antenna lengths for a vertical 27.145 MHz antenna are as follows:

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- Full Wave (936/27.145 = 34.481488) or (approx.) 34½ ft.
- Half Wave (468/27.145 = 17.240744) or (approx.) 17¼ ft.
- Quarter Wave (234/27.145 = 8.620372) or (approx.) 8½ ft.
- Eighth Wave (117/27.145 = 4.310186) or (approx.) 4¼ ft.

Modification of your base and receiver antennas is very easy. Simply connect the desired length of wire antenna to the antenna connection on the back of the transmitter, or if you prefer, connect the transmitter to a standard CB mobile antenna for increased range.

The pager receiver has an internal antenna. Open up the unit with your screwdriver and locate the metal rod or wire antenna mounted on the side of the circuit board. Unsolder this antenna from the circuit board and connect the wire to an enclosed 1/8-inch jack. Then connect a plug to your antenna wire and you are operational. Test the completed unit by driving a distance from the transmitter with it left in the "page" mode. Turn your pager on and off frequently to determine the effective range.

PLACING THE COMPLETED UNITS IN ENCLOSURES

The desired enclosure is again based on your mission and your area conditions. If you are going to use the unit in an urban environment, it can be camouflaged to appear to be a common radio receiver. If the mission requires the unit to be used as an assassination device for a target operating a motor vehicle, use the vehicle's radio antenna for the receiver antenna and, obviously,

mount your receiver and charge underneath the seat of the target occupant.

If, for tactical or intelligence reasons, you wish for the unit to be destroyed in the blast, put the receiver in a plastic bag with sufficient white phosphorous or a 50 percent mixture of potassium nitrate (saltpeter) and sugar, and place the receiver directly on top of the charge. It is further advised that you use a very thin strand of bell wire for your antenna.

This modified alarm paging unit has numerous advantages over most of the units described in this field manual. Because of the ease of modification, it is suggested that you keep the unit in its original unmodified condition until you are ready to deploy the device. This eliminates a legal problem should you be discovered with this common consumer device in your possession.

The applications for this unit are virtually endless. The device can be used in a variety of different RC detonation missions and is perhaps the easiest to modify and operate. Be advised that the use of the unit's operating frequency for any application other than its intended purpose is prohibited by law.

Chapter 9

Modification of a Wireless Intercom and Toy Walkie-Talkie

The standard "hands free" intercom radio used by motorcycle enthusiasts, as well as the typical children's toy walkie-talkie, operates on the 49 MHz frequency, similar to the cordless phone described earlier.

These battery-operated devices have a typical range of about one-quarter mile. The range can be extended with the same type of wire antenna described earlier. These devices can be used with your DTMF unit and, because of their low cost, are best suited for short-range assassination missions where the unit will be destroyed in the blast. These devices are available in very small packages; the batteries are generally good for six to ten hours of continuous use.

The tactical limitations of these devices are outlined in the cordless phone section. Use of these devices with the DTMF RC units is not suggested in the urban environment, because cordless phone users dialing out from their remote units will be sending DTMF signals over the 49 MHz frequencies, and it is technically feasible that they could detonate your charge if they hit the right code combination.

This type of unit is best suited for quick field

use in a remote environment at close range. It is certainly not the most suitable unit to use, but it is discussed here primarily to enable its deployment if it is the only type of unit available for RC detonation.

Chapter 10

Modification of a Radio Paging System

Radio pagers are often used by professionals to keep in touch with their offices while in the field. These devices are very common in any urban environment throughout the world.

Most of these devices are accessed through a phone number that is dialed from any touch-tone phone. The phone call connects to a radio transmitter, which sends a digital signal over the air. The specific pager (or beeper) demodulates the signal and sends current to the tiny electronic beeper on the circuit board, which then sounds off, notifying the user that he has a message back at his office.

Radio page devices can operate on numerous frequencies. Most operate in the 155 to 165 MHz frequencies throughout the world. These tiny VHF receivers have one specific application in RC detonation work—Command may have a need to assassinate a specific target in an urban technological area, such as a foreign capital. The major metropolitan areas of most foreign countries all have these radio paging units in place.

By placing the unit and a suitable charge in proximity to the target, or where intelligence dictates the target will be at a specific time, it is

possible to be out of the country prior to detonation. This provides Command with the capability of safe emplacement of the charge, selective detonation from a long distance using the telephone system, and extraction of personnel from the occupied area prior to detonation, thus eliminating possible capture after the assassination is complete and forces are mobilized.

Modification of a radio pager is quite simple. It is suggested that you perform this modification as close to your departure time as possible. Open the unit up and locate the small beeper unit inside. Unsolder this device and connect two wires to the circuit board where the beeper was connected. Connect these wires directly to your blasting cap connections. (**Note:** For use with military-grade blasting caps, use a 5 VDC relay at the page terminals. Connect the battery and blasting cap to the switching terminals on the relay to provide 1 amp for one second.)

It is suggested that you get the pager several days prior to deployment so you can test the unit for false signal reception. Once you have determined that the unit is not at all sensitive to false alarms, then you can confidently arm and emplace this unit.

The best place to locate these units and possibly even "requisition" one is at a major metropolitan hospital in your target area. The pager unit generally has the activation telephone number labeled on the side or back of the device.

The pager is small and reliable, and operates for several days on fresh batteries. The target can be effectively hit using this device when all personnel associated with the mission are thousands of miles away from the target area. Although use of the radio paging system for

RC detonation work is somewhat limited, this procedure has been used by many foreign intelligence agencies and terrorist groups in both western Europe and the Middle East for some time.

It should be pointed out that these crystal-controlled devices are relatively easy to detect due to the oscillation of the intermediate frequency (IF) stage in the circuitry. If you suspect that such a device is in use, it can be detected using standard ECM gear designed to detect hidden transmission devices.

Chapter 11

Modification of a Cellular Mobile Telephone

The cellular mobile telephone is becoming popular throughout the civilized world. These devices are made for both hand-held use and installation in vehicles. Because these devices are accessed with a telephone, the application and emplacement of these units make them suitable for use as an assassination medium, similar to the radio pager.

Cellular mobile telephones (CMTs) operate in the UHF frequencies of 800 MHz. They are short-range transceivers that operate throughout the area by transferring over to individual repeater locations or cells as the operator moves through a specific metropolitan area. Because these devices are popular with typical military and government targets, their use as assassination tools is described in this field manual.

Modification of this device is very simple. Open the handset of the unit and connect your blasting-cap wires to the ringer terminals. Disconnection of the ringer is not necessary. The voltage to the ringer is quite sufficient to detonate the cap. A small charge placed in the phone unit should be more than sufficient to cause mortal trauma to someone in close proximity to

the unit in an enclosed vehicle.

Portable hand-held units provide mobility and more selective emplacement of the device for long-range assassination missions. Be aware that these devices can also be detected using standard ECM equipment.

Chapter 12

Using a VHF Scanner as Your Receiver

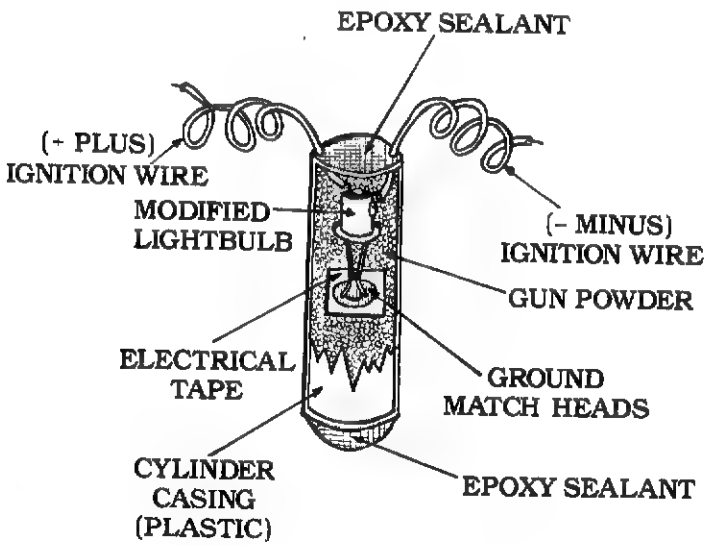
The standard VHF scanner is either crystal-controlled or operates using a synthesizer to tune a specific frequency. These common devices are very reliable. They are discussed here because of their frequency stability and sensitivity, and flexible frequency selection. By connecting your DTMF receiver or tone-control module to the earphone or speaker jack of the scanner, you can use your standard-issue VHF portable transceiver (walkie-talkie) to detonate a charge from as far away as 35 miles.

The procedure is simple. Select a frequency in the band-width capability of your team radio, and either program the scanner or insert the proper frequency crystal in the device. Then lock out all other frequencies on the scanner's channel-selection program board and you are operational.

The scanner can, of course, be modified for extended range using the antenna procedures outlined in this manual. The VHF scanner can be used for medium-range detonation when a *high* degree of reliability is desired in a heavy-congestion urban environment with a lot of radio traffic.

Several manufacturers offer single-channel or 2-channel VHF receivers that are inexpensive and very suitable for this application. Radio Shack offers an inexpensive 2-channel model, called the PRO-27, model #20-108.

Although this device can be used with most improvised munitions, it is *not* suitable for military grade C-4, or other high temp ignition required devices or compounds.



Use epoxy to seal both ends of the cylinder in place of tape, if available for a better blast detonation (also makes device waterproof).

Figure 6. Improvised Field-Expedient Electrical Detonation Device Using a Lightbulb.

Appendix A

Improvised Field-Expedient Blasting Cap

If most of your munitions are improvised from materials accessible to you in your AO, it is possible that you do not have a means of electrically detonating your demolition charges, such as a blasting cap. This section is intended to provide you with a method to create your own.

A blasting cap is an electrical device used to ignite an explosive charge. The cap usually requires from 0.5 volts to 3 volts DC to ignite. Blasting caps can also ignite from an electrical storm or even nearby radio transmission (as those personnel trained to use them can readily attest).

The improvised cap explained here is more stable in design. It will not detonate without a direct electrical charge, and it is also much less sensitive to humidity and moisture.

REQUIRED MATERIALS

- Flashlight bulb (1.5 to 12 VDC)
- Cartridge powder from M16, .45, or 9mm round; or black powder
- 5 matches
- 12 inches of hook-up wire

- One cylinder-type container (ballpoint pen, IV needle case, etc.)
- Electrical tape, solder, etc.

The flashlight bulb can be any voltage. If you wish to use a specific voltage, these Radio Shack stock numbers can be used:

Voltage	Size	Stock Number	Current Required
2.33	E-10	272-1124	270 ma
2.38	Flashlight	272-1122	270 ma
2.38	Flashlight	272-1120	500 ma*
2.47	E-10	272-1132	300 ma
3.57	Flashlight	272-1121	500 ma
4.75	Flashlight	272-1151	500 ma
4.8	Flashlight	272-1125	500 ma
5.95	Flashlight	272-1123	500 ma
6.3	E-10	272-1128	150 ma
7.5	E-10	272-1133	220 ma
8.63	Flashlight	272-1166	500 ma
12.0	E-5	272-1143	75 ma

*This is the standard PR-2 bulb issued in U.S. two-cell flashlights.

Select the bulb that uses the voltage you have available for your charge detonation. If the charge is going to be placed in an automobile, use the 12-volt bulb and the car's battery for the detonation power source.

You will need your soldering iron (or gas torch) as well as wire cutters and needle-nose pliers for this modification.

Use your needle-nose pliers to carefully break the glass around the light-bulb filament. This is a very delicate job. It is best to shatter the top portion of the glass first, and then pull away the fragments of broken glass around the base of the bulb with the pliers. Use care near the fine wire

of the filament and be sure to inspect the filament when you are finished. Use your VOM to verify that the filament is still intact by setting the VOM on Ohms and measuring the resistance of the bulb at the tip and side of the base. It should read close to 0 Ohms.

Cut your 12-inch hook-up wire into two 6-inch strips and strip the insulation back ½ inch on each end of both wires.

Warm up your soldering iron. As it heats up, use a file or a piece of sandpaper to rough up the side of the metal base of the bulb. This will ensure a good electrical connection when it is soldered.

Solder one wire to the bottom of the bulb base very carefully with a small amount of solder. Don't leave the tip on the area too long or you will melt the plastic base of the bulb. Solder the other wire to the filed or sanded area of the side of the bulb base. Again, don't leave the iron on the unit for a long time.

Once completed, test the unit again at the ends of the wires for continuity. If it tests "good," wrap the base of the bulb in one layer of electrical tape.

Using your pocket knife, scrape the heads off the matches and grind the particles into a fine powder. Put this powder in the center of a ½-inch piece of electrical tape. Lay the tip of the bulb filament on top of the match heads on the tape and cover with another ½-inch piece of electrical tape.

Test the completed unit again with the VOM before you go on to finish the cap. Now fill the cylinder tube with the cartridge powder, leaving just enough room at the top for your bulb filament and match-head ignition device.

Wrap the top of the cylinder with electrical

tape and perform one final test with your VOM. Depending on how much black powder you used, it is best to detonate this device from a safe distance and from behind cover. Construct and test at least five of these devices before you deploy one in your homemade demolitions charge to ensure that you have mastered this useful technique.

To detonate this cap, you simply apply the proper voltage to the two wires. These devices are not sensitive to static charges because of the relatively high current required to detonate them. The improvised cap can be used to detonate pipe bombs as well as most improvised fertilizer-based charges when used with sufficient black powder. The device can also be used with most flammable liquid explosive devices as well.

With a bit of experimentation, other useful electrical detonation devices can be made from local materials. Most hobby stores sell model-rocket engine ignition wires, which can be used instead of the light-bulb filament to ignite the powder charge. A model-rocket-manufacturing company can provide these as well. One very well known firm you can contact for these devices is:

The Teleflite Corp.
11620 Kitching Street
Sunnymead, CA 92388

Appendix B

Recommended Reading List for Further Information

Subject	Source
Antenna Handbook Bill Orr W6SA1 192 Pages (#H145)	*Popular Communications* 76 N. Broadway Hicksville, NY 11801
Antennas Tandy Corp. 127 pages (#62-1083)	Radio Shack
Basic Electronics Tandy Corp. 464 pages (#62-1395)	Radio Shack
Beginner's Guide To Reading Schematics Robert J. Trasiter 140 pages (#T215)	*Popular Communications* 76 N. Broadway Hicksville, NY 11801
Easy Up Antennas Ed Noll W3FQJ 235 pages	Ed Noll P.O. Box 75 Chalfont, PA 18914

Electronics Data Book Tandy Corp. 155 pages (#62-1382)	Radio Shack
FCC Regulations U.S. Government	Government Printing Office Superintendent of Documents Washington, DC 20402
Getting Started in Electronics Forest M. Mims, III 128 pages (#276-5003)	Radio Shack
Landmobile and Marine Technical Manual Ed Noll W3FQJ 576 pages	Ed Noll P.O. Box 75 Chalfont, PA 18914
Radio Handbook Bill Orr W6SA1 1,168 pages (#S197)	*Popular Communications* 76 N. Broadway Hicksville, NY 11801
Shortwave Propagation Handbook George Jacobs W3ASK 154 pages (#H137)	*Popular Communications* 76 N. Broadway Hicksville, NY 11801
Semi-Conductor Reference Tandy Corp. 286 pages (#276-4011)	Radio Shack

Understanding Telephone Electronics Tandy Corp. 256 pages (#72-1388)	Radio Shack
Vertical Antenna Handbook Capt. Paul H. Lee N6PL 139 pages (#H208)	*Popular Communications* 76 N. Broadway Hicksville, NY 11801
Vertical Antennas Bill Orr W6SA1 192 pages (#H303)	*Popular Communications* 76 N. Broadway Hicksville, NY 11801

Glossary

AC—Alternating current
AM—Amplitude modulation
Amps—Amperes; unit used to measure electrical current
AO—Area of operations
CB—Citizens band
CMT—Cellular mobile telephone
DC—Direct current
DEMO—Demolitions
DIP—Dual in-line package
DTMF—Dual Tone Multi-Frequency
ECM—Electronic countermeasures
FCC—Federal Communications Commission
FEAR—Field-Expedient Audio Modulated Relay
FM—Frequency modulation
HF—High frequency
KHz—Kilohertz
Ma—Milliamps
MHz—Megahertz
Ohms—Unit used to measure resistance of a device
PCM—Pulse-coded modulation
RC—Radio control; Remote control
RDF—Radio direction finding
RF—Radio frequency

RFI—Radio frequency interference
SF—Special Forces
UCW—Unconventional warfare
UHF—Ultra high frequency
VHF—Very high frequency
Volts—Unit used to measure electrical current
VOM—Volt-Ohmmeter

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